THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method for drilling a subterranean formation comprising the steps of:

rotating a PDC drill bit; and

periodically imparting a rotary impact into the drill bit.

2. The method of claim 1 wherein imparting of the rotary impact comprises the steps of:

rotating an inertial hammer to store potential energy; and

periodically impacting the rotating inertial hammer with a rotary anvil on the drill bit so as to impart the stored potential energy to the drill bit.

3. The method of claim 1 wherein the rotary impact is only imparted to the drill bit when the drill bit bears against the formation.

4. A method for drilling a subterranean formation with a PDC drill bit depending from a drill string, the method comprising the steps of:

providing an assembly adjacent the drill bit;

rotating the assembly to rotate the drill bit; and

periodically impacting the rotating hammer with an anvil on the drill bit so as to impart the stored potential energy to the drill bit.

5. The method as described in claim 4 wherein the hammer is rotated using drilling fluid.

6. A rotational impact assembly for a drill bit comprising:

a housing adapted to be rotated by a rotary drive;

a bit extending from the housing and being rotatably driven thereby; and

a rotary drive located in the housing for periodically and rotatably impacting the drill bit.

7. The rotational impact assembly of claim 6 wherein the housing further comprises a bit shaft through which the drill bit is rotatably driven.

8. The rotational impact assembly of claim 7 wherein the bit shaft is adapted for limited rotational freedom relative to the housing so that when rotationally impacted, the bit shaft can rotate slightly and independent of the housing

rotation whereby the drill bit receives substantially all of the rotary impact without engaging the housing.

9. The rotational impact assembly of claim 6 wherein the rotary drive is a motor driven by drilling fluids.

10. The rotational impact assembly of claim 6 wherein the rotary drive is driven by a drill string.

11. The rotational impact assembly of claim 9 wherein the motor is a turbine.

12. The rotational impact assembly of claim 9 further wherein the motor comprises a stator shaft having a first downhole position and in which a frictional interface is engaged between the stator shaft and the housing to prevent operation of the motor, and a second uphole position in which the frictional interface is disengaged for permitting operation of the motor.

13. A rotational impact assembly for a drill bit comprising:

a housing adapted to be rotated by a rotary drive, the housing having a bore;

a motor located in the bore for rotating a stator shaft;

a bit shaft extending from the bore of the housing and being adapted at a downhole end for rotatably driving the drill bit; and

means for periodically coupling the stator shaft and bit shaft for co-rotation whereby rotational energy is transferred from the stator shaft to the bit shaft.

14. The rotational impact assembly of claim 13 wherein the coupling means comprise:

an annular mass rotated by the stator shaft and having a radially extending hammer; and

an anvil extending radially from the bit shaft and adapted to be impacted by the hammer.

15. The rotational impact assembly of claim 14 further comprising:

a carrier driven by the stator shaft and in which the annular mass is carried about the bit shaft;

means for alternating the position of the annular mass between concentric and eccentric positions about the bit shaft upon each rotation of the stator shaft, the carrier and annular mass being rotated concentrically so as to cause the

hammer and anvil to couple, and the annular mass then moving eccentrically so as to decouple the hammer from the anvil.

16. The rotational impact assembly of claim 15 wherein the means for alternating the annular mass position comprises:

a first pin affixed in the carrier and at a tangent of the annular mass for enabling the annular mass to pivot eccentrically;

a second pin affixed in the carrier diametrically opposed to the first pin and at a tangent of the annular mass, the annular mass having circumferentially elongated notch formed in its tangent for permitting limited the eccentric movement of the annular mass, the eccentric movement being sufficient to decouple the hammer and anvil.

17. A rotational impact assembly for a drill bit comprising:

a housing adapted to be rotated by a rotary drive, the housing having a bore;

a motor located in the bore for rotating a stator shaft;

a bit shaft extending from the bore of the housing and being adapted at a downhole end for rotatably driving the drill bit;

an annular mass rotated by the stator shaft and having a radially extending hammer; and

an anvil extending radially from the bit shaft and adapted to be impacted by the hammer whereby rotational energy is transferred from the stator shaft to the bit shaft.

18. The rotational impact assembly of claim 17 further comprising:

a carrier driven by the stator shaft for carrying the annular mass about the bit shaft;

an offset pin in the carrier about which the annular mass can pivot between concentric and eccentric positions about the bit shaft so that upon each rotation of the stator shaft, the carrier and annular mass are rotated concentrically so as to cause the hammer and anvil to couple after which the annular mass pivots to the eccentric position so as to decouple the hammer from the anvil.

19. The rotational impact assembly of claim 18 further comprising a second pin in the carrier and diametrically opposed to the first offset pin, the annular mass having circumferentially spaced stops which alternately position the annular mass between the concentric and eccentric positions.

20. The rotational impact assembly of claim 17 wherein the motor is rotated by drilling fluids flowing to the drilling bit.